

PSYCHE.

THE PRIMITIVE NUMBER OF MALPIGHIAN VESSELS IN INSECTS.— II.

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APTERYGOTA. In searching for the ancestral conditions of the Malpighian vessels it is natural to turn first to this group. The few data are, however, very unsatisfactory on account of the wide differences between the statements of authors. As an example we may take *Lepisma*. According to Ramdohr* this insect has two Malpighian vessels; according to Treviranus, † Rovelli, ‡ Gegenbaur§ and v. Siebold, || four; according to Leuckart, ¶ six; according to Schindler, ** eight. Fernald says †† that he was unable to ascertain

the number, but feels certain that there are at least four.

In *Machilis Grassi** found twelve Malpighian vessels, uniting in pairs and hence "on peut les considerer comme étant au nombre de six." But Oudemans, † who has studied the anatomy of *Machilis* very carefully, finds twenty vessels, uniting in pairs and opening by means of ten apertures at the junction of the mid and hind-guts.

Camptopoda has about 16 Malpighian vessels according to Grassi. † These organs were seen by Oudemans§ but he failed to ascertain their exact number.

According to Grassi|| both *Nicoletia* and *Lepisma* have six Malpighian vessels, opening separately into the hind-gut.

* Abhandlung ueber die verdauungs werkzeuge der insecten. Halle, 1811.

† Vermichte schriften Bd. ii heft. 1, p. 15. Göttingen, 1816.

‡ Alcune ricerche sul tubo digerente degli atteri, ortotteri e pseudo-neurotteri. Como., 1884.

§ Grundriss, etc., 1874, p. 292.

|| Anatomie d. wirbellosen, p. 625.

¶ Frey u. Leuckart, Anatomie u. physiologie d. wirbellosen, p. 102.

** Beiträge zur kenntniss der Malpighi'schen gefässe der insecten. Zeitschr. f. wiss. zool. Bd. 30, 1878, p. 602.

†† The relationships of arthropods. Studies biol. lab. Johns Hopkins univ. vol. iv, no. 7, 1890, p. 464.

* Les ancêtres des myriapodes et des insectes, tome xi, 1889, p. 310.

† Bijdrage tot de kennis der Thysanura en Collembola, Amsterdam, 1887, p. 66.

‡ *loco citato*, p. 310.

§ l. c. p. 67.

|| l. c. p. 311.

Haliday,* Meinert† and Grassi‡ agree in stating that Malpighian vessels are absent in Iapyx.

Opinions are divided as to the occurrence of Malpighian vessels in the Collembola. Nicolet§ thought he saw three pairs in Podurids and figures them in *Podura similata*. Frey and Leuckart|| and v. Siebold¶ also mention six as the number in Podurids. DeOlfers** saw only four in the Collembola.

On the other hand, Laboulbene†† and Fernald‡‡ find no trace of Malpighian vessels in *Anurida maritima*. Schindler§§ failed to find them in *Podura arborea*, and Lubbock||| had no better success with *Orchesella fastuosa* (a species in which they were figured by von Olfers), *Tomocerus plumbeus*, *Smynthurus* and other species. Tullberg's¶¶ results are also negative.

* Japyx, a new genus of insects belonging to the stirps Thysanura in the order of Neuroptera. Trans. Linn. soc. vol. xxiv, 1864, p. 444.

† On the Campodeae, a family of Thysanura. Ann. mag. nat. hist. vol. xx (3) 1867, p. 372.

‡ l. c. p. 310.

§ Recherches pour servir à l'histoire des Podurelles. Nouv. mémoires de la Société helvétique de sciences naturelles, 1841, p. 47 (pl. iv, fig. 2).

|| l. c. p. 102.

¶ l. c. p. 625.

** Annotationes ad anatomiam Podurarum. Diss. inaug. Berolini, 1862, p. 16.

†† Recherches sur l'*Anurida maritima*. Ann. soc. ent. France. 4^e ser. tome iv, 1864, p. 715.

‡‡ l. c. p. 468.

§§ l. c. p. 602.

||| Monograph of the Collembola and Thysanura. Ray soc. London, 1873, p. 75.

¶¶ Sveriges Podurider. Kongl. svenska vetensk. akad. Handlingar. bd. 10, no. 10, 1872, p. 22.

The majority of recent writers, among whom Oudemans deserves special mention, are of the opinion that the Collembola have no Malpighian vessels.

It is clear that no phylogenetic conclusions of any value can be drawn from the heterogeneous observations here given. After making all due allowance for errors of observation, it is safe to say that the Malpighian vessels of the Apterygota are in a state of what Baron v. Osten Sacken calls "morphological restlessness." The amplitude of variation within the group is very great, extending from twenty vessels in Machilis to none in Anurida and allied forms. There are grounds for believing that this variation is not a precursor of advancing development, but rather an expression of degeneration. Other organs—such as the eyes, tracheae, sexual organs—show a similar great range of structural variation and stamp the Apterygota as a group which has well nigh run its course in Hexapod evolution.

DERMAPTERA. In *Forficula auricularia* according to Ramdohr,* there are twenty Malpighian vessels, inserted in clusters of five on four protuberances of the chylic gut. In the same species Schindler† found the number of vessels to be greater than 30, and their insertions, if I understand him correctly, to encircle the gut regularly.

* l. c. p. 76.

† l. c. p. 604.